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## THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

### SECTION F—ZOOLOGY

#### THE AMERICAN SOCIETY OF ZOOLOGISTS

A JOINT session of the Central Branch of the American Society of Zoologists with Section F, Zoology, of the American Association for the Advancement of Science was held at the University of Chicago, December 30, 1907, to January 4, 1908. This was the sixth meeting of the Central Branch of the American Society of Zoologists, and the largest in its history. President S. A. Forbes, of the Central Branch, presided at all the sessions, as President E. B. Wilson, of Section F, was unable to be present.

The society met at 2:30 P.M., December 30, at which time E. B. Conklin, the retiring vice-president of Section F, delivered an address upon "The Mechanism of Heredity." The following are the titles and abstracts of papers presented at this meeting.

*On the Specific Gravity of the Constituent Parts of the Egg of Chætopterus and the Effect of Centrifuging on the Polarity of the Egg: FRANK R. LILLIE, University of Chicago.*

As the result of experiments with centrifugal forces of graded powers, the author concluded that the protoplasm of the polarized ovocyte of *Chætopterus* possesses both a polar and a concentric organization of its *ground substance*, which is the basis of the so-called "segregation pattern," or arrangement of granules ("sub-

stances'') within the egg, and which determines the axis of embryonic development. This organization of the ground substance is not substantially altered by centrifuging, though it may be temporarily distorted thereby.

These conclusions depend upon the following considerations and observations:

I. *Concentric Organization*.—If the ground substance be perfectly homogeneous, granules moving under the influence of centrifugal force will pass in straight lines centrally and distally, according to their respective specific gravities, and will not be held in any intermediate position. Aggregation of granules in definite configurations or intermediate positions after centrifuging are *prima facie* evidence of differences of resistance of the ground substance.

Such definite configurations are found in the egg of *Chaetopterus* after the action of low centrifugal powers with perfect constancy; and these together with the evidence derived from study of the normal structure enable us to infer the following concentric organization of the ground substance: (1) An ectoplasmic layer of considerable density, open at the animal pole; (2) an intermediate more fluid layer which is especially developed at the animal pole, where it comes to the surface; (3) a ring of greater density, enclosing (4) a large subcentral, more fluid mass. The last corresponds in position and approximately in size with the original location of the large germinal vesicle.

As a consequence of this organization of the ground substance, the small basophile granules within the central, more fluid area aggregate in the dense ring bounding it, when low centrifugal powers are used. This aggregation is situated towards the axis of the centrifuge, as the basophile granules are of low specific gravity, and is lunate in cross-section; it contrasts vividly

with the surrounding parts of the egg after staining in strong basic dyes, such as thionin. Higher powers of the centrifuge drive such granules through the dense ring into the "clear zone" which contains the basophile granules from other parts of the egg. The acidophile granules also show typical configurations. The central, more fluid mass is practically emptied of granules when low centrifugal powers are used, because those within it are driven into the dense ring bounding it and those without do not penetrate the dense ring to enter it.

II. *Polar Organization*.—The polarity of the ovum before and after centrifuging appears to be the same whether the karyokinetic spindle retains its original position or not. This is inferred from the fact that the polar axis of centrifuged eggs (as determined by the position of the polar bodies appearing subsequent to centrifuging, and the later development) bears no constant relation to the axis of stratification of granules produced by centrifuging. Therefore the position of the granules of the egg does not determine its polarity. The latter may, therefore, be either a persistent feature of the ground substance, or may be determined by whatever point on the surface the maturation spindle happens to reach if displaced by centrifuging. The latter proposition appears highly improbable because (1) the polarity of oocytes with intact germinal vesicle does not appear to be determined by the point on the surface to which the germinal vesicle may be thrown by centrifuging (limited number of observations of author); (2) the position of the maturation spindle displaced by centrifuging is constant, viz.: in the clear band, but the polar bodies are frequently formed outside this band; (3) in other animals no cases are known where the position of the nucleus has been shown to determine polarity, but,



on the contrary, the polarity of the ovum is known to determine the position assumed by the cleavage nuclei. Therefore, it is believed that in *Chaetopterus* the ground substance retains its polarity after centrifuging and that the place of formation of the polar bodies is thereby determined.

III. As to specific gravity of the cell contents, the so-called gray cap, which is specifically lightest, is made up of residual substance of the germinal vesicle and numerous small granules that are blackened by osmic acid and are soluble in xylol, hence presumably fat granules. The intermediate or clear band contains the majority of basophile granules; the distal hemisphere contains the acidophile granules, and of these, those originally contained in the ectoplasm appear to be heaviest.

*The Variability of Zygosporos in Spirogyra quadrata (Hass.) formed by Scalariform and by Lateral Conjugation, and its bearing on the Theory of Amphimixis:* L. B. WALTON, Kenyon College.

With the object in view of obtaining data bearing upon the purpose of *amphimixis*, and the causes tending to produce *variability*—problems which have long remained most elusive in everything except theory—a biometrical investigation in respect to the comparative variability and correlation in 400 zygosporos of *Spirogyra quadrata* (Hass.) formed by scalariform and by lateral conjugation was undertaken.

In the first instance (scalariform conjugation) we deal with the results of conjugation between remotely related cells belonging to different filaments. In the second instance (lateral conjugation) we deal with the results of conjugation between sister or adjacent cells of the same filament, a condition closely related to the

phenomena of parthenogenesis in other organisms. If the conjugation of germ cells from remotely related individuals tends to variability as Weismann and others would have us believe, conversely the union of closely related cells should afford a decreased variability, the minimum appearing in parthenogenetic forms.

The results show a condition directly contrary to this, the zygosporos of lateral conjugation being approximately 21 per cent. more variable in length and 31 per cent. more variable in diameter than those produced by scalariform conjugation. Consequently direct evidence is afforded in support of the theory of Hatschek (1887) that sex exists for the purpose of limiting and not for the purpose of increasing variability.

A comparison of constants, the general discussion, methods of measurements, as well as a review of the literature, particularly papers by Warren, Kellogg, Pearson, etc., will be given in the completed paper.

*A Contribution towards an Experimental Analysis of the Karyokinetic Figure:* F. R. LILLIE, University of Chicago.

The alternative hypotheses (1) that the poles of the karyokinetic figure (centrosomes) are centers of force which acts outwards and exerts its effect at a distance (centrosome theory) and (2) that the centrosomes are merely centers of insertion of the organic radii (mitome theory), may be tested experimentally. On the first hypothesis, spindles that move through the protoplasm would produce new asters in the form of radiating "chains of force" (Hartog); on the second hypothesis the moving spindle would drag the organic radii with it and produce considerable distortion of the karyokinetic figure. On the first hypothesis, not only the rays of the asters, but also the fibers of the spindle, must be interpreted as chains of force, and

the chromosomes as well as centrosomes may be centers of force. Therefore, in any movement of the spindle through the cytoplasm, it is conceivable that its material also is constantly changing. If, therefore, the karyokinetic figure were suddenly moved from protoplasm of one morphological character into protoplasm of another, comparison of the normal and experimental conditions of the karyokinetic figure would furnish evidence for deciding between the two hypotheses.

The unfertilized eggs of *Chaetopterus* enable us to make such a test. After they have remained in sea water fifteen to twenty minutes, each possesses a large karyokinetic figure fixed at the animal pole, and this figure remains at the mesophase for hours. If such eggs be centrifuged with relatively low powers (1,150 revolutions in 30 seconds to 1,750 revolutions in 45 seconds) not only may the karyokinetic figure be moved through the cytoplasm, or the latter caused to flow past the spindle, but new configurations arise in the cytoplasm, owing to central or peripheral displacement (with reference to the direction of the centrifugal force) of the granules suspended in the ground substance of the cytoplasm. The most important of these configurations for our purpose is a dense accumulation of the basophile granules a little central to the middle point of the egg. This is a new formation called suddenly into existence, within 30 to 45 seconds, and contrasting strongly with the remainder of either normal or centrifuged eggs.

If a pole of the spindle enter this basophile mass, the granules of the latter appear to be rearranged in radiating lines that can be interpreted only as chains of force. Apparently the original radiations of the pole in question are lost, or are reenforced. The rays of the aster in the basophile mass are actually more numerous

than in the karyokinetic figures of control eggs, as determined by counting.

Any part of the basophile mass that enters the spindle appears also to be rearranged in chains of force: one finds that the part of the spindle within the basophile mass usually stains correspondingly, and thus contrasts strongly with the part without, and this is probably due in the first place to infiltration of basophile granules; but the modified part of the spindle is also fibrous in its structure and the interfilar spaces are empty of granules, so that it would appear that the infiltrated granules are arranged in chains.

Such distortions as are found in either the rays of the aster or the fibers of the spindle are explicable on the chain of force hypothesis; because it has been shown by Hartog that chains of force consisting of iron dust suspended in glycerine or balsam will bear great distortion before rupturing; and this is due in the first place to the fact that the longer path of a distorted chain is more permeable than the relatively resistant medium in which the permeable chains of particles are embedded, and in the second place (to a certain extent) to the viscosity of the medium.

The mitome hypothesis appears inadequate to explain the results of the experiments, and may certainly be regarded as disproved if actual counts show a definite increase in the number of astral rays proceeding from the pole embedded in the basophile mass.

If the center of force hypothesis be accepted, the results show that the basophile granules are extremely permeable to the "mitokinetic force" (Hartog) and that the ground substance is highly impermeable. Acidophile granules are also impermeable; or at least they are not arranged in chains of force.

*The Pacific Scientific Institution:* WM. A. BRYAN, Honolulu, T. H.



The institution recently incorporated in Honolulu has as its immediate object the promotion of a thorough biological and ethnographical survey of the Pacific Islands. Its more inclusive object, however, as stated in its charter, is "to encourage in the broadest sense and most liberal manner investigation, research and discovery in the Pacific Ocean and to make application of knowledge thereof to the improvement of mankind."

It is the design of the incorporation to create an international cooperative research institution in Hawaii by the affiliation of institutions at home and abroad, that will provide in the center of the region to be studied, a modern institution with adequate funds and facilities to carry forward rapidly the work of discovery and exploration and to make the practical application of the new facts thus gathered to the scientific and economic betterment of the world.

An especial board of trustees has been named to receive in trust, funds and property with which to promote the objects of the institution. Substantial progress has already been made toward providing such important facilities as a biological station, botanical garden and an aviary or zoological garden, all of which, as organized, will form departments of the institution and be supplementary to the scientific equipment already existing in Honolulu.

The field explorations of the institution will be carried on by an especially equipped yacht provided with auxiliary power. This vessel will use Honolulu as a center, and from it proceed to visit the Pacific islands, group by group. Fifteen years is allowed for completing the field explorations.

An international council composed of distinguished scientists and scholars will select an honorary staff of leading specialists who will have advisory super-

vision over the work, assistants and publications in the especial departments into which the investigation will be divided.

The scope of the general inquiry and survey, the disposition of the material collected, as well as the publications of the institution have been worked out along lines of helpful cooperation with a view to the definite advancement of scientific work in the region to be treated. The whole undertaking has received much favorable indorsement from prominent scientists and educators as well as from philanthropists and men of affairs.

*The Biochemical Action of Copper Sulphate on Aquatic Microorganisms:*  
AMOS W. PETERS, University of Illinois.

The concentrations of  $\text{CuSO}_4$  required to kill protozoa instantly and to inactivate the normal enzymes of their protoplasm were compared. Protozoa—*Paramæcium* and *Stentor*—were freed from debris, separated from other organisms, and washed free from the organic matter of their native culture liquid, by the use of a filter of fine silk bolting cloth upon a separatory funnel, followed by the use of a centrifuge. The concentrations required to kill instantly differed greatly according to conditions, the values found ranging from 12 to  $60 \times 10^{-8}$  gram molecular parts of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  per c.c. The presence of diastatic and various other enzymes in the cell-bodies of these protozoa was demonstrated with complete freedom from such inaccuracy as could arise from the presence of bacteria. The methods used and the results obtained in the preparation of these enzymes will be reported in a separate communication. The diastatic enzymes were tested, with all necessary controls for their action upon starch, and the results were measured by both the Fehling and the polarimetric methods. At the concentration of  $\text{CuSO}_4$  equal to that of the kill-

ing point of the same organisms which furnished the enzyme, diastatic ferments are nearly or completely inactivated and their activity increases as the concentration of  $\text{CuSO}_4$  diminishes. Whether the same correlation exists with other enzymes and whether the cell bodies absorb and concentrate the  $\text{CuSO}_4$  from dilute solution, is still under investigation.

*Minimal Size in Form-regulation:* C. M. CHILD, University of Chicago.

The minimal size of pieces capable of complete form-regulation in a given species is not a constant quantity, but varies according to the region of the body involved and in some species with age. It may also vary to a certain extent with the physiological condition of the individual.

In *Tubularia* and *Corymorpha*, for example, a much larger piece is necessary for the formation of a complete hydranth and stem in the distal region of the original stem than in the proximal region.

In *Planaria maculata* a piece from the middle region of the body must be much larger than one from the terminal regions to produce a complete animal.

Similar differences are found in various other species of coelenterates and turbellaria.

As regards age differences, the minimal size of pieces capable of producing a complete animal is relatively greater in newly hatched specimens of *Planaria simplicissima* than in adult animals, though as regards actual size the reverse is the case.

Evidently, then, minimal size in these species is not simply a matter of a certain number of cells or a certain constant amount of living material, but is dependent rather on the position and function of the parts in the original whole. We may probably go a step farther and assert that it is primarily dependent upon

the rapidity of physiological or functional changes with change of level in the whole. Where this change is relatively rapid a piece of given length is physiologically more nearly a complete system than a piece of the same length in a region or at an age where the change from level to level is less rapid.

These facts constitute strong evidence against the cell theory in its more special form, for the number of cells may differ very widely in minimal pieces from different regions. They point to correlation between parts as the essential feature in regulatory and probably also in normal development—at least in certain stages.

*Galvanotropism of Bacteria:* J. F. ABBOTT, Washington University.

It being ordinarily understood that bacteria do not respond to the influence of a galvanic stream too weak to kill them, it seemed important to determine whether this be really so; and second, to determine, if a tropic response be obtained, in how far this might be altered by change in environmental conditions.

Results of extended work on *B. termo* and *B. subtilis* demonstrated without any question that pure cultures of these bacteria gather under the influence of very weak currents at the cathode and follow repeated reversals of the poles.

Pure cultures grown in acid-modified and alkali-modified peptone-gelatin appeared to respond in most cases, though not in all, in opposite manner, alkali cultures gathering at the cathode and acid cultures at the anode.

These results seem to be in harmony with those of Greeley on paramecium and give color to the conception that the galvanotropic response may be due to, or directed by, the physico-chemical constitution of protoplasm.

Work along this line is being continued.



*Some Reactions of the Pomace Fly (Drosophila ampelophila) to External Stimuli:* FREDERIC W. CARPENTER, University of Illinois.

*Drosophila* is negatively thermotropic to high and low temperatures. In reacting on a horizontal surface to the temperature stimulus the insect usually describes a continuous curved line, and gives little evidence of random movements indicating "trial and error" behavior.

Experiments with light have shown that *Drosophila* is positively phototropic. If one eye is covered with an opaque cap, the insect, in spite of the unilateral stimulation, creeps in a fairly direct path toward the light, although often showing a tendency to deviate toward the side of the normal eye. Occasionally a fly will perform circus movements, but this behavior is exceptional.

A violent uncoordinated motor reaction or convulsive reflex may be produced by stimulating *Drosophila* either by a high temperature, or by a low temperature, or by intense light (at a temperature of 30° C.) or by such irritating chemical substances as ammonia or acetic acid.

*Behavior of Perichæta and Lumbricus toward Stimuli of Various Intensities:* E. H. HARPER, Northwestern University.

Stimulation of the anterior end on one side gives reactions of five types corresponding to the strength of the stimulus. The weak negative reaction of type I. is the terminus likewise of the next two types owing to the gradual subsiding of the stimulus. The medium reaction of type II. is therefore two-phased, retraction of the head being only the first phase. The increased intensity of the first phase in type III. (strong reaction) determines the backward crawling, allowing the posterior end to take the lead. The extension of the same strong condition of contraction

over the posterior end in the very strong reaction of type IV. prevents backward crawling owing to the weaker adaptiveness to backward as compared with forward movements. Strong turning with forward movement is, therefore, the very strong type of reaction. Type V. is a convulsive reaction. Type III. shows three subtypes according to strength of stimulus. Subtype III. (b) introduces squirming of the anterior end; III. (c) includes a rolling reaction produced by contracting the longitudinal muscle bands in sequence, which follows the squirming and precedes the backward movement. This rolling reaction wipes off the stimulating substance with secreted mucus. As variants may be noted omission of backward crawling from III. (b) and (c). Trial and error is not recognized in this apparently determinate series of reactions, though, as others have noted, the movements of type I. may be random. Of course the same description may be applied to V.

*The Reaction of Amphibian Embryos to Tactile Stimuli:* G. E. COGHILL, Denison University.

With reference to the reaction to a tactile stimulus upon the region of the trigeminus or vagus, embryos of *Triton torosus* may be grouped into three classes: (1) Individuals which from the first and during a considerable period respond regularly or almost regularly with a heterolateral (away from the side touched) head movement. (2) Individuals which for a relatively short period are irregular in the direction of the head movement and then enter upon a long period of heterolateral reaction. (3) Individuals which are at first asymmetrical in response, then enter upon a short period of irregularity and finally upon a period of heterolateral reaction, or pass directly from asymmetry to the heterolateral type.

The heterolateral head movement is a unit in the "action system." This unit is predetermined regardless of any experience on the part of the individual. The first response to a touch on the tail bud is a head movement and as the whole trunk comes to be flexed the movement still begins in the head region and progresses caudad. The earliest conduction paths, then, of the lower part of the cord are longitudinal and afferent, and the two halves are physiologically distinct during this phase of development. Specimens that are asymmetrical for head stimulation are so for tail stimulation also.

*The Phylogenetic Differentiation of the Organs of Smell and Taste:* C. JUDSON HERRICK, The University of Chicago.

Physiologists have not yet succeeded in finding a well-defined criterion for the separation of these senses in terms of the character of the stimulus, nor can they be easily distinguished psychologically. Nevertheless, their nervous mechanisms are very different and these anatomical differences seem to have assumed practically their definite form in the very lowest vertebrates. In seeking for the explanation of this differentiation of two chemical senses in low aquatic vertebrates, attention is directed to the character of the motor responses as giving the key to the evolution of the very diverse reflex paths for smell and taste. The typical response to stimulation of the taste buds within the mouth is a visceral reaction (mastication, swallowing, etc.); that of olfactory stimuli is a somatic reaction, usually toward or away from the source of the stimulus. A quite different set of nervous pathways is involved in the latter case from that of the former. Assuming that smell and taste have evolved from a common type of undifferentiated chemical sense, this difference in mode of reaction to chemical stim-

uli within and without the mouth is adequate to call forth in the course of further evolution the structural differences which we find between these organs in higher vertebrates.

*The Mesencephalic Root of the Trigeminal in Reptiles and Mammals:* J. B. JOHNSTON, University of Minnesota.

This bundle of fibers has long been known in man and mammals and described as the descending or cerebral motor root of the trigeminal. The writer has described it in selachians, ganoids and anurans as a part of the sensory root. The same is now found to be true in reptiles (turtle, snake) and in mammals (mole, cat, white rat, pig embryo and human embryo of 15.5 mm.). In the adult mammals studied the bundle in question is made up of two parts. One part arises from the spinal trigeminal tract at about the level of the facial nerve, runs dorsalward through the substantia gelatinosa, turns cephalad between the gelatinosa and the vestibular centers, passes over the dorso-caudal surface of the motor nucleus of the trigeminal, and gains the internal face of the brachium conjunctivum near the fourth ventricle. Here it is joined by the second part, which comes up from the sensory trigeminal root among the trigeminal fibers to the cerebellum. The combined bundle has on its mesal and ventral side a column of large and small cells which is closely related to (merges with) the vestibular nuclei. The bundle and column of cells continue forward into the mesencephalon in the well-known manner.

In the human embryo studied (and pig embryos also) the relations of the sensory and motor roots at their connection with the brain are such that there seems no possibility of confusing the two. The bundle under consideration is made up in the same way as above described and is further



clearly separated from the motor root by the intervening lateral groove of the brain. This groove separates the dorsal and ventral halves of the brain wall (Flügelplatte and Grundplatte, His); the sensory root and the mesencephalic bundle are dorsal to this groove, the motor root ventral to it. The sensory and motor portions of the trigeminus are at this time widely separated. At the level of the exit of the fourth nerve the mesencephalic bundle holds a position between the central and peripheral limbs of the trochlearis which is characteristic for all vertebrates. Dorsal to the peripheral limb of the trochlearis, however, is to be seen in the human embryo a large bundle which runs from the tectum mesencephali into the cerebellum, the tr. tectocerebellaris which occupies this same position in lower vertebrates. Hence, the cutaneous sensory fibers are distributed through the whole length of the dorsal half of the brain wall as far forward as the superior colliculus. *The roof of the midbrain is still in part a primary cutaneous sensory center, even in man.* This gives the strongest morphological support to the account of the evolution of the cutaneous, auditory and visual primary and secondary reflex centers and the cerebellum out of a primitive longitudinal column or zone whose functions were at first simple cutaneous sensory.

*The Epibranchial Placodes of Ameiurus melas and nebulosus:* F. L. LANDACRE, Ohio State University.

The epibranchial placodes in *Ameiurus* arise just posterior to the dorsal portion of each gill slit and give rise to elements in the cranial ganglia quite distinct from those of the dorso-lateral placodes and of the neural crest.

The ectodermal area in which the placodes occur is indicated first by active mitosis and later by a process of prolifera-

tion which is almost complete; and the ganglion is almost detached from the ectoderm before it comes into contact with cells from the dorso-lateral placode and neural crest except in the case of the third division of the tenth nerve.

The placodal portions of the seventh, ninth and first two divisions of the tenth nerves have been followed to a late stage and give rise to the portions of these ganglia which furnish communis fibers to these nerves.

Whether the epibranchial ganglia furnish gustatory fibers only or general visceral fibers also has not yet been certainly determined, but the evidence is very strong that they give rise to special visceral or gustatory fibers only.

The direction of proliferation of the placodal cells is backward, and their first connection with the remaining portions of the cranial ganglia is by means of a delicate intermediate cell mass.

*Pinkus's Nerve in Amia and Lepidosteus:* CHAS. BROOKOVER, The University of Chicago.

Search for Pinkus's nerve in adult *Amia* by macroscopic and microscopic methods failed to show the root which Allis described running back to the forebrain. The ganglion was found as Allis described it in larval *Amia*. A similar ganglion was found in larval stages of *Lepidosteus osseus*. The cells of the ganglion become scattered in *Amia* after the 50 mm. stage, when there are two hundred and fifty cells. In adult *Amia* the large cells from the larval ganglion were recognized to the number of one thousand on each olfactorius. They have the appearance of functional nerve-cells among the olfactory fibers as the latter break up into small bundles to enter the Schneiderian membrane.

There is some evidence that the cells are those of a sympathetic ganglion in *Amia*.

Each of the thousand cells does not send an axone back into the brain unless these fibers enter the olfactory bulb under the guise of osmotic axones. Such Golgi and Cajal preparations show morphological similarities to sympathetic cells. There are many points of similarity between Pinkus's nerve in the bony ganoids and Loey's *nervus terminalis* in sharks. There are two ganglia in the course of the nerve in *Squalus acanthias* and some of the cells are multipolar.

*The "Primitive Pores" and the Sensory Ridges of the Lateral Line of Polyodon spathula:* HENRY F. NACHTRIEB, University of Minnesota.

The "primitive pores" or pits. The many-layered epithelium of the skin passes, without change, into the mouth of each pit and then gradually becomes reduced as it passes toward the bottom of the pit, where it consists of two layers or of two distinct layers with interspersed pseudostratified areas. The cells are of two distinct types. The more conspicuous cells are large, clear columnar cells resting upon the basement membrane and containing centrally located nuclei with two to six distinct nucleoli (using the term in a general sense). The other type is, as a rule, a more or less flattened cell lying on the outer ends of the basal cells. They fit in closely between the rounded ends of the basal cells and consequently have an uneven lower surface. For convenience we may call them cover cells. Each cover cell contains a large, more or less irregularly shaped nucleus with, as a rule, but one nucleolus. Some of these cover cells clearly extend to the basement membrane, and various stages between a definite cover cell and a basal cell, with reference to both the cytoplasm and the nucleus, have been observed. A basal cell may be completely covered or send a small finger-like projection up between the con-

tiguous covering cells, or there may be a pore-like opening above it between the cover cells. The cells here called basal cells have been designated as supporting cells and the cells corresponding to what are here called cover cells have been designated sense cells, thus interpreting the pit as a sense organ. There are no structures supporting this interpretation. Well-preserved material and the elimination of all artifacts indicate that the primitive pits of *Polyodon* are simple glands that secrete a peculiar mucus-like substance.

The sensory ridges of the lateral canal are about .6 mm. long and in transverse sections cover the floor (or wall next to the muscles) of the canal. The epithelium is a simple flat epithelium excepting in the sensory ridges, where it is more or less columnar and consists of two types of cells. One is a relatively large clear cell resembling the basal cells of the primitive pits. These cells either do not rest on the basement membrane at all or only through very thin extensions. The other rests upon the basement membrane, and is a more slender and more irregularly shaped cell with a distinct oval nucleus. In the neighborhood of the clear cells, they generally overlap or cover the outer ends of the clear cells. Neither type of cell has any peculiarly differentiated free surface. As in the case of the primitive pits fine nerve fibrils end between the cells. A more or less evident network has been observed on some of the denser cells, which appear to be of two kinds, a supporting and a sensory cell. Clear cells discharging their contents into the canal are not infrequently seen in well-preserved material. While hairs or hair-like processes have not been definitely made out on any of these cells, the innervation and general appearance as well as the experiments of Parker and others indicate that these ridges are sense organs. There is no evidence that the primitive pits are



or ever have been a part of the lateral line system.

Microscopic preparations were shown in connection with the paper.

*Cranial Nerve Components in Amphiuma:*

H. W. NORRIS, Iowa College.

A preliminary outline of the more salient features of the origin and peripheral distribution of the cranial nerves of *Amphiuma* with reference to their components. Kingsley's account of the I. and II. nerves is confirmed. The eye-muscle nerves have the typical origin, but are all rudimentary, especially the VI. The IV. and VI. have not been described hitherto. The V. nerve is characterized by anastomoses with branches of the VII. Its origin is that described for *Necturus* by Kingsbury. The VII. nerve arises by five rootlets: three lateral line, one each communis and motor. In addition it receives general cutaneous and communis fibers from the IX. Branches: (1) *supra-orbital trunk*, lateral line (*ophthalmicus superficialis* VII.) and general cutaneous (V.); (2) *infra-orbital trunk*, lateral line (*buccalis* VII.), and general cutaneous (*maxillaris* V.); (3) *palatine*, communis; (4) *hyomandibular trunk*, lateral line, general cutaneous, communis and motor. The hyomandibular give rise to: the *alveolaris* (communis), *mentalis externus* and *mentalis internus* (lateral line), *jugularis* (general cutaneous, motor, together with some lateral line fibers), and the *ramus lateralis* (lateral line mostly, if not entirely). The *ramus lateralis* VII. is peculiar to *Amphiuma*. It runs to the posterior part of the body, but its neuromasts on the trunk of the body have not been determined. In addition to the anastomoses already mentioned the VII. nerve has the following: between the palatinus VII. and the *ophthalmicus profundus* V.; in the manner described for *Amblystoma* by Coghill; be-

tween the *alveolaris* VII. and *mandibularis* V.; between the *ophthalmicus profundus* V. and the *ophthalmicus superficialis* VII. and *buccalis* VII.; between the *alveolaris* VII. and the pretrematicus IX., two anastomoses; between the palatinus VII. and the pretrematicus IX., Jacobson's commissure; between the *jugularis* VII. and the IX.-X. ganglion, anastomosis IX.-X. and VII. The latter anastomosis has only general cutaneous and communis fibers. The IX.-X. nerve complex arises from the brain by five groups of rootlets. Peripherally the branches of the IX.-X. agree in general in their distribution with those of *Amblystoma* as described by Coghill. The first branchial nerve (IX.) contains only communis and motor fibers; the second and third branchial nerves (X.) contain general cutaneous, communis and motor fibers. A fourth branchial nerve, poorly developed, arises from the *ramus intestinalis*. The first spinal nerve (*hypoglossus*) arises by four rootlets, two dorsal and two ventral, as described by Kingsley. It does not anastomose with the X. nerve.

*The Participation of Medullated Fibers in the Innervation of the Olfactory Mucous Membrane of Fishes:* R. E. SHELDON, The University of Chicago.

In the carp (*Cyprinus carpio*) medullated fibers enter the submucosa region of the olfactory capsule distributing in part to the Schneiderian membrane. There they probably end in free nerve terminations, as there are no special end organs developed. These fibers are derived from the supra-orbital trunk, which is made up of general cutaneous fibers from the Gasserian ganglion (n. *ophthalmicus superficialis trigemini*) and sensory fibers from the facial (n. *ophthalmicus superficialis facialis*). This latter nerve is acustico-lateral from the lateralis ganglion of the facial and visceral sensory from the gen-

iculate. The fibers entering the mucosa are certainly not lateralis, as no canal or pit organs are there found; the fibers are also smaller than are the lateralis fibers. They may, therefore, be either general cutaneous or visceral sensory, with the preponderance of evidence in favor of the former, partly on the ground that the medullated innervation in mammals and birds, the other forms in which such fibers are known, is trigeminal and partly because the weight of evidence in the teleosts is against the supposition that visceral sensory fibers are present in this region. Young cod and gold fish were studied with reference to the presence of medullated fibers in the mucosa, but none could be demonstrated.

*The Ischio-coccygeal Plexus as a Pathway for Cutaneous Innervation in the Leopard Frog:* ELIZABETH HOPKINS DUNN, The University of Chicago.

Gaupp in the 1896 edition of Ecker's und Wiedersheim's "Anatomie des Frosches" makes no mention of a cutaneous innervation by way of the ischio-coccygeal plexus, branches from which are there traced to the pelvic viscera and the posterior lymph heart.

In dissection of the ischio-coccygeal plexus of *Rana pipiens* the nervus coccygeus was found to send several terminal branches to a limited area of the skin about the cloacal opening.

At the point in the nerve at which the last visceral branch is given off a study of the relations of the individual fibers was undertaken. The last visceral branch contains from fifteen to twenty medullated fibers, the cutaneous portion about forty medullated fibers.

The small number of medullated fibers at this point makes possible the isolation of the individual fibers by teasing in gly-

cerin. One per cent. osmic acid was used as a fixing and staining reagent.

A careful study of material, including the trunk of the nerve above the point of branching and the visceral and cutaneous branches in their continuity with the main trunk, revealed in three consecutive preparations the division of at least one medullated fiber in each preparation occurring in the trunk just above the point of separation of the branches. Of these dividing fibers one limb passed toward the viscera while the other continued with the cutaneous portion of the nerve.

The weight of evidence seems to be in favor of the afferent character of these fibers.

If this be true, unless an independent functional value can be established for the individual neuro-fibrillæ in the neuraxis, it would appear that we have in such a distribution of the ramifications of a single nerve fiber an anatomical explanation for the close connection between visceral and cutaneous areas which has been suggested by the findings on the pathological side shown by Head's classic work on disturbance of sensation with reference to visceral disease.

A close physiological connection between the pelvic viscera and the adjacent regions may also be accomplished by means of such dividing fibers.

*Degeneration in the Ganglion Cells of Cambarus bartonii Gir:* HANSFORD MAC-CURDY, Alma College.

Within the last decade a large number of experiments have been performed on vertebrated animals to ascertain to what extent the nerve roots, ganglia and ganglion cells are affected when a nerve trunk has been severed. The results have varied greatly, but in by far the greater number of these experiments, distinct alterations in the size and structure of the parts affected



have been reported and in some cases complete degeneration of ganglion cells has been said to occur.

In a series of experiments on the abdominal ganglia of the crayfish, *Cambarus bartonii* Gir, ganglion cells have been found to undergo degeneration in twenty to thirty-eight days after the connectives anterior and posterior to the fifth ganglion have been severed. A smaller number of cells were affected in the fourth and the sixth than in the fifth ganglion. The histological changes in these ganglion cells are apparently similar and correspond to those described for similar structures in the nerve cells of vertebrate animals.

*Place-modes for the Sacrum and the First Hæmal Arch of Necturus*: FRANK SMITH, University of Illinois.

Data on the sacrum and first hæmal arch of 504 specimens of *Necturus* form the basis for place-modes of these two characters in specimens collected in Lake Erie at Venice, Ohio.

Of sacra involving two symmetrically placed sacral ribs, eight are modifications of the eighteenth vertebra, 347 of the nineteenth, 78 of the twentieth and two of the twenty-first. Two specimens have each two pairs of sacral ribs, one pair each on the nineteenth and one on the twentieth vertebra. Fifty-two specimens have two sacral ribs asymmetrically disposed. These involve two of the eighteenth, nineteenth, twentieth and twenty-first vertebra and are found in five of the six possible relations. Twenty-five have the right sacral rib in advance and 27 the left one. Fifteen specimens have three sacral ribs which involve two of the eighteenth, nineteenth and twentieth vertebrae and have seven of the eight possible relations. Four have the unpaired rib anterior to the paired ones, and the others have it posterior.

The first hæmal arch is on the twenty-

second vertebra in 177 specimens, on the twenty-third in 303 and on the twenty-fourth in 24. In two specimens a half hæmal arch is formed on the twenty-first vertebra. Of thirty sacral ribs borne on the eighteenth vertebra, all but one are associated with a hæmal arch on the twenty-second, and nearly all are in males. The correlation coefficient between the position of the sacrum and that of the first hæmal arch is  $.47 \pm .013$ .

Three hundred and nine specimens examined for sex include 129 males and 180 females. A comparison of the mean positions of the sacral ribs and of the first hæmal arches of the sexes shows clearly that the sexes should be considered separately in determining place-modes. Variability in both characters is somewhat greater in the males.

Mean of positions of attachment of sacral ribs in 504 Lake Erie specimens,  $19.19 \pm .014$ ; in 129 males,  $19.126 \pm .03$ ; in 180 females,  $19.28 \pm .025$ . Mean of positions of first hæmal arch in 504 specimens,  $22.70 \pm .015$ ; in 129 males,  $22.57$ ; in 180 females,  $22.82$ . These means are exceeded by the corresponding ones for the 100 specimens studied by Bumpus by an amount greater than that involved in the probable errors.

*The Habits and Structures of the Larva of Culex perturbans*: JOHN B. SMITH, Rutgers College.

The larva of *Culex perturbans* is unlike that of all other known culicid larvæ in that it does not live in free water or merely on the bottom surface. It works its way into the soft bottom mud a distance of from two to four inches and attaches itself by its modified anal siphon to the roots of grasses. By means of serrated processes it breaks through the outer surface of the roots, attaches itself by means of recurved hooks, and obtains its

supply of oxygen from the vascular system of the plants. The swamp areas inhabited by this species are those densely overgrown with grasses in which no other mosquito larva lives and among which no fish or other enemies are found. (See *Entomological News*, Vol. XIX., page 22, plates 3 and 4, January, 1908.)

*Note on a Trematode Parasite in a Hen's Egg from Northern Minnesota:* W. S. NICKERSON, University of Minnesota. (Read by title.)

*A Comparison between the Implantation Stages in Dipodomys and Geomys:* THOMAS G. LEE, University of Minnesota.

A study of a series of early developmental stages in *Dipodomys* taken previous to and during the process of the implantation of the ovum shows a general correspondence with the same stages in *Geomys* as previously described by the writer.

*Dipodomys* is the third rodent so far described in which the decidual cavity is formed in the ventral portion of the uterine mucosa outside of and independent of the uterine lumen. Perforation of the ventral portion of the uterine epithelium and the extrusion of the blastocyst occurs at a somewhat earlier stage of development than in *Geomys*. Consequently, the opening between the uterine lumen and the newly formed decidual cavity is at all times much smaller proportionally in *Dipodomys* than in *Geomys*. The blastocyst in *Dipodomys* does not become attached to the margin of this opening as is so characteristic of *Geomys*, but sinks down into the decidual cavity.

In both *Dipodomys* and *Geomys* there is for some time a functional yolk-sac placenta which is later substituted by an allantoic placenta.

*The Ecological Succession of Bird Associations:* CHAS. C. ADAMS, University of Chicago.

The breeding grounds of birds must be considered as fundamental in any attempt to determine their habitat relations. Those species which regularly breed in the same habitat form a bird association or society. The succession upon Isle Royale, Lake Superior, has been attempted by the study of the history of the environment correlated with the character of the birds. From a reef in the lake to the forested island there has been a definite environmental change; and, correspondingly, in all probability, a corresponding change in the bird life. Upon the habitat preferences of the present avifauna the general succession in the past may be roughly approximated. As the lake level lowered and the depressions became invaded by the forest, the aquatic association has been succeeded by the shore and bog-forest kinds; and these in turn by the birds frequenting the aspenbirch-balsam or maple forest. All habitats, under present conditions, tend to become transformed into that of the climax forest, with its avifauna or association. This method of environmental interpretation, as a problem of succession, gives a new point of view for the study of the development or evolution of the avian environment and the "struggle for existence" among birds.

*A Statistical Study of Midsummer Birds of Illinois:* S. A. FORBES, University of Illinois.

This paper contains a preliminary statement of some of the more general results of a census of summer resident birds of Illinois, giving the entire bird population of a strip 150 feet in width and 428 miles long (12 square miles), one third of this area being in southern, one fourth in central, and two fifths in northern, Illinois.



The method of the enumeration was such as to give the numbers of each species found on measured areas, taken at random, of each crop or other distinguishable kind of surface. The responsible observer, Mr. A. O. Gross, determined 7,740 birds belonging to 85 species—an average of 645 birds to the square mile, of which 18 per cent. were English sparrows. On this basis, the total summer population of the state numbers about 30,750,000 birds, of which five and a half millions were English sparrows. Eighty-five per cent. of these birds belonged to one fourth of the species. The ten most abundant species, and the numbers seen of each, were as follows: English sparrow, 1,414; meadow-lark, 1,025; bronzed grackle, 900; mourning-dove, 461; dickcissel, 393; red-winged blackbird, 347; prairie horned lark, 296; flicker, 197; robin, 194; and field sparrow, 186.

The English sparrows decreased in numbers per square mile from north to south (perhaps because of a diminishing population southward and a consequent progressive diminution of their breeding areas), 100 sparrows in northern Illinois being represented by 77 in central and 56 in southern; but the native birds increased from north to south, apparently for climatic reasons—100 in northern Illinois being represented by 116 in central and 129 in southern. The same gradation was still more pronounced in winter residents, which averaged 384 birds to the square mile in northern, 582 in central and 832 in southern, Illinois. The general average for the whole state and the entire year, as represented by 1,591 miles of travel and a census area of  $44\frac{1}{2}$  square miles, was 722 birds to the square mile.

By comparison of the midsummer numbers with the average for the fall migration period, a wave of denser population was detected, running from north to south

and rising with the progress of the migration. The central Illinois average for October was 2.3 times that for July, August and early September.

The original relation of the Illinois bird fauna to prairies was still discernible in the fact that half of these summer birds were found in pastures and meadows, although only a little over a third of the area inspected was in grass. Corn fields, on the other hand, which covered 32 per cent. of the area, contained but 15 per cent. of the birds, and these most largely English sparrows.

As an example of the local and numerical distribution of species, that of the meadow-lark was given, and as an example of the composition of the bird fauna of an ecological situation, the birds of the pasture were separately discussed. Meadow-larks, while numbering 85 to the square mile for the whole area covered, were very unequally distributed, averaging 266 to the square mile in fields of stubble, 205 in meadows, 144 in pastures, and 10 in corn fields, and not occurring at all in forests or among shrubbery. They increased notably in number from north to south—100 in northern Illinois being represented by 175 in central and 215 in southern.

Pasture lands were the preferred resort of the most abundant midsummer species, and contained 27 per cent. of all the birds seen. In average density of population, however, they were surpassed by meadows, which contained 920 for each square mile, to 878 in pastures, 562 in stubble and small grain, and 300 in fields of corn. The commonest pasture birds were the English sparrow, the crow-blackbird, the meadow-lark, the horned lark, and the field sparrow, abundant in the order named, and together making more than half the summer residents of the pasture lands of the state.

The impression made by this general examination of the present bird population of the state of Illinois was that of a remarkable flexibility and tenacity of the associate and ecological relationships of birds in the face of revolutionary changes in their environment. Apart from the results of the introduction of the English sparrow, and the direct destruction of game birds and birds of prey, the main effect of human occupation seems to have been the withdrawal of most of the prairie birds from the area devoted to Indian corn, and their concentration in pastures, meadows, and fields of small grain—situations which most nearly resemble their original habitat.

*Significant Changes in the Breeding Ranges of Certain Birds of the Ohio Valley and Lower Lake Region:* LYND JONES, Oberlin College.

These changes, during a period of seventy years, are a gradual but decided shifting northward of the breeding areas of twenty-five species of birds, or fully twenty per cent. of the breeding birds of the state of Ohio. The movement can not be accounted for by the changes attendant upon the settlement of the region, because the breeding habitats have not been materially changed. Rather the northward movement seems to be the expression of a gradual elimination of the less fit and as gradual an improvement of the species.

*The Relation of Ecology to General Biological Problems:* A symposium by H. C. COWLES, V. E. SHELFORD, C. C. ADAMS, the University of Chicago. To be published in full in SCIENCE.

*A Study in the Sex-ratio in Drosophila Ampelophila:* W. J. MOENKHAUS, University of Indiana.

The sex-ratio in *Drosophila ampelophila* is 1 male to 1.14 females. The sex-ratio is inherited. If the sex-ratio of many pairs

of this species taken from the same parents as determined in different pairs shows a wide range of variation in this respect. The ratio may vary from a slight preponderance of males to a strong preponderance of females in a proportion of 1 to 2 or greater. By breeding the offspring from pairs showing a selected ratio, these again show a ratio approaching that of their parents. Thus, by selection, a strain in which the females bore a relation 1.6 to 1 male was produced. This ratio, by selection, can be maintained. A male strain has not yet been attempted.

By mating females from the "female" strain with males from a strain in which the sex-ratio is 1 to 1, and *vice versa*, the sex-ratio of the offspring is in every case that of the strain from which the females were selected. From the results in five such experiments it is concluded that in this creature the sex is determined altogether, or nearly so, by the female, the male having nothing or little to do with it.

The objection that might easily be brought forward, that the selection in these experiments may be nothing more than the selection of those pairs in which one sex or the other tended to die and, hence, led to a preponderance of one sex or the other, has not been met satisfactorily experimentally, but it is not regarded as a factor of any importance.

THOMAS G. LEE,  
Secretary

UNIVERSITY OF MINNESOTA  
(To be concluded)

#### SCIENTIFIC BOOKS

SCIENTIFIC PUBLICATIONS OF THE AMERICAN  
MUSEUM OF NATURAL HISTORY FOR 1907

IN Volume XXIII. of the *Bulletin* of the museum there are almost one thousand—978, to be exact—printed pages, comprising thirty-six separate papers from nineteen authors, with fifty-three plates and eighty-three text figures. Many papers are of typical tech-



nicality, others have a wider range and engage popular attention.

The very enviable fame enjoyed by the American Museum for its unsurpassed halls of vertebrate paleontology suggests the precedence of the papers on this topic; indeed, by enumeration, over one third of the titles belong here.

The first paper is by Dr. L. Hussakof: a short description of the fossil surgeon fish, *Zebrasoma deani* n. sp., from the West Indies, and significant as the first instance of a fossil of the family being found in America. It is hypothetically referred to the Eocene. The second paper is by Dr. W. D. Matthew, devoted to the elaboration of a lower Miocene fauna from South Dakota, which, it is contended, connects the latest of the White River beds (Oligocene) with the Loup Fork sediments (upper Miocene) and which is characterized by two rather sharply contrasted faunas, that of the lower Rosebud beds and that of the upper, in both of which are found Carnivora, Rodentia, Perisso and Artiodactyles and (in the upper Rosebud) Insectivora, and of which finally the author says: "It is peculiarly satisfactory therefore to find a fauna which is intermediate between two stages hitherto disconnected, and enables us to perceive the exact relationships between genera which could until now be connected only in a general or provisional way." The details given in this paper are very interesting, as that the resemblance of the Oligocene and lower Miocene Canidæ (Canidæ and Mustelidæ alone appear in the Carnivora) to species inhabiting South America is marked, that the specialization of the limbs and feet of lower Miocene hares "were practically as far advanced as any of their modern descendants," and the description of a new genus of mustelines, *Megalictis*, and of which "the teeth indicate an animal fully as predaceous as the wolverene but the skeleton points to more fossorial habits." At many places in this important contribution there is impressed upon the reader the sense of the writer's detached judgment, his freedom from preconception or prejudice, and a willing deliberation in drawing conclusions.

Professor H. Fairfield Osborn furnishes four articles, among which the "Tertiary Mammal Horizons of North America" easily claims preeminence. It is an effort at correlation which will be closely studied, and offers a résumé of the observations of a host of investigators in the field. The faunal currents indicated in the sixth phase, with South American land connections, and in the fifth and seventh phases with Eurasiatic invasions, suggest the speculations which the distinguished author has successfully associated with his name. The remaining three papers of Professor Osborn are "Mounted Skeleton of the Columbian Mammoth," "Points of the Skeleton of the Arab Horse" and "A Mounted Skeleton of *Naosaurus*," in which last the two plates, one of the skeleton and one of a restoration or model by Charles R. Knight, fairly startle the observer.

Mr. E. C. Case contributes three articles, two of systematic value, "The Skull of *Bolosaurus striatus* Cope," "The Genus *Zatrachys* Cope" and a geological estimate, of much interest, of the Permian beds of Texas. A very suggestive study, in so far as it is charged with a consideration of morphological changes and their possible causes, comes from the pen of Professor Earl Douglass; it is entitled "New Merycoidodonts of Montana," and discusses a fossil group of artiodactyles related to the Cervidæ. An excellent paper by Mr. Barnum Brown forms article XXXIII. and analyzes the contents and relations of "The Hell Creek Beds of Montana." Dr. O. P. Hay follows the last writer with the description of "Seven New Species of Turtles from the Tertiaries of the United States." These turtles prove to be of striking interest. One, *Macrochelys temminicki* Hay, was found in probable Pliocene deposits on the western coast of Florida. It was about the size of the alligator snapper which inhabits to-day the region from western Georgia to Texas, but is quite distinct in structure; another species is a new box-tortoise "found in Pliocene or early Pleistocene deposits near Savannah, Georgia, and which exceeded in size any living species of box-tortoise." Among these suggestive fossils an example of *Aspideretes* (A.

*singularis* Hay) possesses unusual value. "The specimen is beautifully preserved and furnishes the nearly complete skeleton. Only one other skull belonging to the Trionychoidea is at present known that is older, and no other trionychoid skull so old is known that is accompanied by the shell." The papers in vertebrate paleontology close with one by J. W. Gidley in which the author presents a "Revision of the Miocene and Pliocene Equidae of North America."

Near the center of the volume is an imposing article by the editor, Dr. J. A. Allen, which recalls a conflict which lately occupied the pages of this journal. The article is entitled "The Types of the North American Genera of Birds," and is a vigorous plea for the principle, in nomenclature, of elimination.

There are two articles by Professor R. P. Whitfield, the founder of the *Bulletin*, and the veteran paleontologist of the United States, one describing, for the first time, a species of *Hoploparia* (a lobster) from the American Cretaceous, and the second upon the interesting *Unios* brought by Mr. Barnum Brown from the Laramie clays of Montana.

Entomology has in the recent issues of the *Bulletin* increased its claims upon the space of the publication; indeed a process of cleavage in the *Bulletin* itself might not inappositely follow, as a consequence of the swelling proportions of entomological themes. There are fourteen entomological papers, some of them of very considerable length and all noteworthy, with particular interest centering in those of Beutenmüller, Wheeler and Cockerell.

Mr. Beutenmüller contributes "Notes and Descriptions of New Forms of Catocala," "New Species of Gall-producing Cecidomyiidae," "Notes on North American Cynipidae" and an authoritative study of the "North American Species of Rhodites and their Galls."

Professor Wm. M. Wheeler is the author of two extended papers of unquestionable interest. The paper on "The Polymorphism of Ants" repays attentive perusal. The subject of course pertains to the most fascinating

chapters of science and the skillful and experienced author develops it with unmistakable attractiveness. The second paper of Professor Wheeler's introduces the reader to a second domain of entomology and leads him to the homes and environment of the "Fungus-growing Ants of North America." As Professor Wheeler almost instinctively remarks, "not only are these habits of interest as a most unusual specialization in diet—for all ants were originally and many are still exclusively entomophagous—but the successful cultivation of such delicate plants as fungi presupposes an astonishing range and complexity of adaptation even for these very plastic insects."

Professor T. D. A. Cockerell contributes four excellent articles dealing particularly with the fossil insects and spiders of Florissant, Colorado. Mr. James G. Needham describes two new genera of *Æschninæ* (dragon flies); Dr. W. D. Kearfott, "Microlepidoptera from the Black Mountain Region of North Carolina," and James A. G. Rehn, some Australian Orthoptera.

A geological paper by Dr. E. O. Hovey upon the "Western Sierra Madre of the State of Chihuahua, Mexico," conducts the reader most instructively through regions of tropical tablelands, intervening bolsons; over "wastes of sand and arid soil, held in place to some extent by bunch grass, greasewood and mesquite"; across river-traversed or lake-dotted plains, the narrative being plentifully interspersed with geological studies of igneous intrusions, erosions, metamorphism, mines and physical features, of which perhaps the extremely level basin floors are not the least striking. The paper is well illustrated.

The volume also contains an interesting paper on Australian and Asiatic bees described from specimens belonging to the museum, and an especially informing and luminous article by Alexander G. Ruthven on a "Collection of Reptiles and Amphibians from Southern New Mexico and Arizona," a region which in several directions has furnished zoological novelties and stimulated the curiosity and zeal of collectors.

The anthropological publications of the mu-



seum comprise "Gros Ventre Myths and Tales," "Religion of the Arapaho" (the latter in the series of the Mrs. Morris K. Jesup Expedition), both by A. L. Kroeber, and "The Shasta," by Roland B. Dixon, under the results of the Huntington California Expedition.

L. P. GRATACAP

#### SOCIETIES AND ACADEMIES

##### THE AMERICAN CHEMICAL SOCIETY NORTHEASTERN SECTION

THE eighty-fourth regular meeting of the section was held on Friday, April 24, at eight o'clock P.M., at the Tech Union, Boston. About fifty members were present. Professor W. H. Walker, of the Massachusetts Institute of Technology, presented a paper on "The Corrosion of Iron and Steel," with illustrations. Pure iron is very rare, but has been prepared by the reduction of pure ferrous oxalate in a vacuum furnace. Small amounts of sulphur, carbon, phosphorus, etc., have marked effects upon the properties and corrosion of iron. Iron and steel as made at the present time appear to corrode more rapidly than products made forty years ago. (A sample of iron known to have been exposed to the weather for thirty-four years was shown with little corrosion, while a sample of steel fence wire exposed only six years was very much corroded.)

The theories of corrosion were outlined as follows:

*Carbon dioxide theory:* this was the earliest and has been supported by many authorities and appears in the text-books. The reactions proposed are:  $4(\text{Fe} + \text{H}_2\text{O} + \text{CO}_2) = 4\text{FeCO}_3 + 4\text{H}_2$ , and  $4\text{FeCO}_3 + 6\text{H}_2\text{O} + \text{O}_2 = 4\text{Fe}(\text{OH})_3 + \text{CO}_2$ . This theory appears to account for the facts that corrosion is accelerated by the presence of carbon dioxide, and that alkalies inhibit corrosion. Certain experiments of G. T. Moody appeared to show that no corrosion occurs if carbon dioxide is absent.

*Electrolytic theory* proposed in 1903 by W. R. Whitney was based on the following experiments: Iron immersed in copper sul-

phate solution became plated with copper, since the copper ions with positive charges have a less electrolytic solution pressure than the iron. Since water is slightly dissociated, its hydrogen acts as a metal, and hence iron, when put into water, dissolves at a rate proportional to the concentration of hydrogen ions in the water, and to the relative ease with which hydrogen can be liberated upon the iron. Any acid which increases the concentration of the hydrogen ions will thus accelerate corrosion, while alkalies which decrease the hydrogen concentration will inhibit corrosion.

A repetition of Moody's experiments in detail established his observed facts but not his conclusions. Using phenolphthalein, it was found that alkali dissolved from the glass apparatus was sufficient to account for the slow action at first. Immersion of the iron in chromic acid renders the iron passive. But using Jena flasks carrying capillary tubes through the stoppers, and boiling the water, then quickly introducing a piece of iron and boiling again, all oxygen and carbon dioxide was expelled. While still boiling the capillary was sealed. After several days no corrosion could be observed, but on concentrating the water in a platinum dish, a good test for iron was obtained in each case, using sulphocyanate. Numerous repetitions of the experiments with elaborate precautions to prevent occlusion of gas in the iron, showed that iron went into solution every time. This supports the electrolytic theory. When bits of iron were immersed in water containing a little potassium ferricyanide and phenolphthalein, surfaces of opposite polarity on the iron soon became manifest; points at which hydrogen is liberated, *i. e.*, cathode points, became red, since hydroxyl ions are there set free. The anode points became blue, owing to the iron going into solution. The rate of solution of iron in water depends upon the electrolytic solution pressure of the iron and the hydrogen, upon the osmotic pressure of the iron ions in solution, and upon the "over-voltage" which must be overcome before the hydrogen ions pass from the ionized to the free state. The solution of iron in water becomes con-

tinuous if the cathode portions are depolarized. By using hydroxylamine or potassium dichromate as depolarizers it was found that the iron dissolved from the anode was equal to that added to the cathode portion. Oxygen acts as a depolarizer, as was shown in an experiment with a porous cell filled with, and surrounded by, water containing both ferricyanide and phenolphthalein, and connecting a piece of iron in the cell with a platinum plate in the outside liquid. The platinum showed a red color and the iron colored the liquid blue. But if the platinum were dipped in pyrogallol solution to remove oxygen from its surface, no action appears for some time until oxygen is absorbed from the air. Various experiments proved the rate of corrosion of iron in water to be a linear function of the partial pressure of the oxygen in the atmosphere above the water.

The passive condition of iron caused by chromic acid may be due to a film of oxygen formed on the iron. If heated in a vacuum this oxygen is removed; also the presence of small amounts of electrolytes destroy the inhibiting effect, and the method is of doubtful industrial value.

The more homogeneous the iron, the better it resists corrosion, since there is less opportunity for local currents to be set up. The segregation of phosphorus, sulphur, manganese, etc., in steel ingots, necessitates discarding 5 to 20 per cent. of the top of the ingot, to produce a uniform and homogeneous product. Presence of much manganese in steel indicates also much sulphur and phosphorus and hence much segregation.

Considerable discussion followed the paper and the view was expressed that both iron and steel of high degree of purity and homogeneity should be reasonably resistant to corrosion. Numerous specimens of corroded and uncorroded old iron and steel were shown, and also solutions containing phenolphthalein and ferricyanide made solid with agar-agar and containing bits of iron, to demonstrate the progress and phenomena of corrosion.

FRANK H. THORP,  
Secretary

#### THE GEOLOGICAL SOCIETY OF WASHINGTON

At the 204th meeting of the society, on April 8, the following papers were presented informally:

#### *A Wolframite-topaz Ore from Alaska:* ADOLPH KNOPF.

At the Oregon claim, Lost River, Alaska, an argentiferous ore, consisting of wolframite, galena and stannite embedded in a gangue of radial topaz with subordinate fluorite, forms a stringer lode 1 foot wide. The mineralization has taken place along a line of faulting in a dense-textured limestone of Ordovician age. Topaz is regarded as distinctive of cassiterite veins, and this occurrence of topaz as a carrier of sulphide minerals, therefore presents a number of novel features.

Mr. F. E. Wright exhibited informally three contact minerals—gehlenite, hillebrandite and spurrite, from Velardeña, Mexico, collected by Messrs. J. E. Spurr and G. H. Garrey and examined by the speaker. Of these, gehlenite appears not to have been observed before on this continent, while hillebrandite and spurrite are new species.

#### *Regular Program*

#### *Studies in Mechanics of Allegheny Structure:*

Mr. GEO. H. ASHLEY.

A brief review of Appalachian structure as a whole, the recent theories as to the causes therefor, and some figures from the structure west of the Allegheny front in central Pennsylvania were presented. A study of the Chestnut Ridge anticline southwest of Punxsutawney shows that with a chord of 14 miles and a rise of 740 feet, the folding involved a shortening of  $4.9388 +$  feet. If the arch were self-supporting it would exert a tangential thrust of about 290,000 tons per square foot, or about 1,000 times the crushing strength of the materials, so that it must always have been supported from below. Furthermore, had the segment of the arch been filled by the excess matter due to a crustal shortening of  $4.938 +$  feet, a wedge 2,244 miles deep would have been required, an impossibility if isostatic adjustment be true. It would seem, therefore, that the segment was



probably filled by material moved out from the adjacent synclines so that the structure from one syncline to another actually approached a convex arch between two concave arcs. The total structural shortening northwest of the Allegheny front was between 35 and 40 feet.

The faulting in the Allegheny tract from Alabama to Pennsylvania shows remarkable parallelism in lines approximately  $45^\circ$  from the strike of the folded structure or from the direction of the force causing the folding. These faults were always of the type known as "normal"; but the fault faces showed striae running from  $37^\circ$  to  $65^\circ$  from the horizontal, indicating a large horizontal element in the motion. Although entirely normal, the dislocations were evidently due to the yielding of the rocks under high tangential pressure along stress planes.

*Secondary Enrichment in Granite-Bimetallic mine, Philipsburg, Montana:* W. H. EMMONS.

The Granite-Bimetallic lode is a tabular body of silver ore from 1 to 20 feet wide which has been stoped for 4,500 feet along the strike and 2,600 feet in depth. The vein fills a fissure in monzonite along which there has been but little movement. The primary ore has a gangue of quartz and rhodochrosite inclosing a large quantity of pyrite, arsenopyrite, tetrahedrite, and tennantite, with some galena and zinc blende. Sparingly scattered through this ore are small specks of pyrrargyrite, realgar and orpiment. This ore carries from 20 to 30 ounces of silver and from \$1.50 to \$3 in gold. Above the low grade sulphides extending from 500 to 1,000 feet below the surface is a zone of enriched oxide and sulphide ore in which the primary ore is cut by veinlets of ruby silver, argentite, native silver and horn silver. This ore carries over 100 ounces silver and \$5 gold. Above the rich oxide and sulphide zone is a zone of leached oxides which extends to the surface. This ore carries less than 40 ounces silver and \$2 gold.

An analysis of the mine water from a long drainage adit shows that it contains .000,147  $\text{SO}_2$ , .000,160 iron with traces of silver and

gold. These figures indicate that about .6 of a ton of iron and sulphate compounds are carried out of the mine every twenty-four hours. It is well known that iron sulphate solutions will dissolve silver and that these are precipitated again by the action of sulphides which carry an excess of sulphur. Enrichment was favored by a relief which furnished an ample head; by fracturing of the vein subsequent to the deposition of the primary ore; and by abundance of sulphides in the primary ore.

*Revision of the Age of Niagara Falls:* Mr. J. W. SPENCER.

From the now partially buried remnants of the river banks Mr. James Wilson, C.E., and the writer were able to locate the position of the falls at the time of Father Hennepin's visit (1678). It was thus found that the rate of recession in 227 years had been substantially the same as during the 63 years between the survey of Hall (1842) and of the writer (1904-5), namely, an average rate of 4.2 feet a year. The recession of the American Falls is very slow, and this water added to the main falls would increase them by only five per cent.

Through soundings it was found that the present mean rate of recession of 4.2 feet a year has obtained only since the Falls passed a point 1,100 feet below the apex, with an effective height in recession taken at 180 feet. The time required was 260 years. Thence, northward, for 6,200 feet, the mean effective height (on account of the absence of the barrier at the Whirlpool Rapids) was 240 feet, with the rate of recession thereby increased to 5.6 feet a year. Beyond, for 10,200 feet, to near Sinclair Point, the effective height was 260-280 feet, increasing the rate of retreat to 6.5 feet a year, with the necessary time ratio of 1,570 years. As the Whirlpool only required the clearing away of the drift material, no time allowance is made for its opening. From its outlet to the head of Foster Flats (3,200 feet), with the water descending 240 feet, the rate was 5.6 feet a year, requiring 570 years. Thus, the Falls have receded about four miles, with the full volume of the

river (except for a slight diversion, noted by Taylor) in 3,500 years.

From the head of Foster Flats to the end of the canyon is a distance of about three miles, and in the retreat of the Falls throughout this section only the Erie waters supplied the river (15 per cent. of the present). While receding 600 feet past the upper end of Foster Flats the height of the Falls was 240 feet, with rate of recession 15 per cent. of 5.6 feet. The proportional time allowance was 700 years. Below this point, for a distance of 13,300 feet, there were two and three falls, but the work of the upper one is now so well established that it alone furnishes the data necessary for computations. The mean height was 105 feet, and with the volume of 15 per cent. of that of the present day, the proportional rate of recession was reduced to 0.42 of a foot. This increased the time required to 31,600 years. There still remain 450 or 500 feet of the gorge to its end. Here the height of the Falls was 35 feet, so that their recession, with the small volume of water, was very slow, or proportionally only an eighth of a foot a year, at which rate 3,200 years were required. Thus, the formation of this lower and older stretch of the gorge required 35,500 years, or 39,000 for the total recession. The above figures are based on the assumption that the rainfall has been secularly uniform, with no greater increase of the drainage basins than at present.

PHILIP S. SMITH,  
Secretary

#### THE TORREY BOTANICAL CLUB

THE meeting for April 29, 1908, was called to order at 3:45 P.M. by Vice-president John Hendley Barnhart. Fourteen persons were present.

The following abstracts were submitted by the authors of the papers presented:

*The Boleti of the Forest Herbarium*: WILLIAM ALPHONSO MURRILL.

This paper will shortly be published in full in one of the periodicals of the club.

*Suggestions for Future Work on the Flowering Plants of the Local Flora*: ROLAND M.

HARPER, chairman of the Phanerogamic Division of the Committee on the Local Flora.

There is probably not another spot in North America which has so many different kinds of country within a short distance of it as New York City. In consequence of this geographical diversity there are found within one hundred miles of here over one half of the species of flowering plants credited to the northeastern United States and adjacent Canada.

The earliest botanists in this region had their hands full with merely collecting, classifying and describing the plants. After nearly all the species had been described the next step was to record the known localities for each, and to prepare "floras" of certain limited areas. Since the middle of the nineteenth century a great deal of attention has been paid to anatomy, physiology, pathology and cryptogamic botany. Nomenclature was a leading topic for discussion among botanists a decade or two ago, and a little later ecology came into prominence, but for various reasons the latter has not proved very attractive to amateurs, at least here in the east. Experimental evolution is now attracting considerable attention, but there are very few persons qualified for this kind of research.

At the present time amateurs seem to be doing very little to advance our knowledge of the local flora, but there is no good reason why this should always be so. Notwithstanding the inroads of civilization, and the vast amount of botanical work that has already been done in this vicinity along certain lines, there are still awaiting solution here innumerable problems which can be successfully attacked by any one possessed of a fair knowledge of plants and a little spare time.

Very little of the vegetation of this vicinity has been described, still less photographed, our natural habitats have hardly been classified, and some of them have never even been adequately defined. Our dunes, marshes and Palisades, the pine-barrens of Long Island and New Jersey, and various other easily accessible places have been little damaged by civilization, and offer a fertile field for study, but the



opportunities for ascertaining their natural condition are growing less every year, so no time should be lost.

We have very little definite knowledge of the flowering periods, modes of dissemination, natural habitats and boundaries of the ranges of some of our most familiar plants. To illustrate some of the many taxonomic, geographical, ecological, phænological and statistical problems which now confront us, a list of about twenty illustrative questions was submitted, and recommended to the consideration of the members of the club. Answers to them, or suggestions of similar questions, were earnestly invited.

The paper will be published in full in a future number of *Torreyia*.

*Exhibition of Specimens recently collected in Jamaica, with Remarks:* N. L. BRITTON.

A specimen was exhibited of the nest of the Jamaica swift made from the downy seeds of species of *Tillandsia*, and presented to the New York Botanical Garden by F. B. Sturridge, Esq., of Union Hill, Moneague, Jamaica.

Fruits were also shown of the Jamaican species of *Hernandia*, preserved in formalin, together with herbarium specimens from the same tree, found by Mr. William Harris and myself on the wooded hill near Dolphin Head, a mountain near the western end of Jamaica, and collected March 21, 1908. This tree is one of the largest of the Jamaican forests and apparently either very rare or very local in its distribution. It attains a height of at least 30 meters and a trunk diameter of over a meter. It has not been very definitely known to botanists, inasmuch as Patrick Browne in the "Civil and Natural History of Jamaica," published in 1756, knew of its occurrence there only by rumor, and it is not recorded for Jamaica by Grisebach in the "Flora of the British West Indian Islands." In the treatment of the genus in De Candolle's "Prodromus," Meissner attributes it to Jamaica on the authority of Patrick Browne, but Mr. Harris, in his extensive exploration of the forests of the island, had not been able to find much of it until this discovery near

Dolphin Head, where a tree some 20 meters high was cut down and fine fruiting specimens obtained. An examination of these specimens in comparison with those of the other species indicates that the Jamaican tree differs from those of the other West Indies and of the East Indies, and should be defined as a species new to science.

C. STUART GAGER,  
*Secretary*

DISCUSSION AND CORRESPONDENCE

THE ADAMS FUND

It is needless to repeat in this paper what the Adams Act is, except to emphasize that the appropriation was made for the purpose of conducting original investigations in all branches of agricultural science, and that those institutions and investigators that draw from the funds keep before them the obligation under which they are placed when they accept the conditions of the funds. There is, I think, a certain class of workers in the experiment stations who fear that the work under the Adams Fund will prove too technically scientific, and therefore seem to think that greater latitude should be accorded each station in the use of its pro rata of the funds.

During the many years that experiment stations have existed in this country, with few exceptions, they have done mostly demonstrative work, and results have necessarily been empirical, and admitted only of local application. Many of them have spent their time and energy farming, and making special experiments with fads, trying to eradicate "foggy notions" about the effect of the dark and light nights on planting ordinary farm crops, or satisfying any popular belief. The demands that have arisen from time to time among the farmers, especially the southern farmers, have been of this nature, and have determined in a great measure the progress of some of the stations. Even now, we sometimes hear arguments to the effect that experiment station work should never overshoot the heads of the average farmers, and even in scientific work we should try to simplify the work so the farmer can understand it.

I am by no means a favorer of anything

done at experiment stations that does not eventually redound to the good of the farmer, but, at the same time, I would have uppermost in mind what really benefits the farmer, not so much what he thinks benefits him. Institutions of this kind are organized for the purpose of deriving far-reaching conclusions, and the schemes to be worked out should be determined by those who have made a deep study of agriculture in its broadest sense, and not by those who have had handed down to them the ideas they daily put in practise. Agriculture is the greatest of all vocations, at least of all industries, and yet it is only recently that science has been directed along agricultural lines, and it has probably been well for the work that the above conditions have existed. In the first place, there were few men who were prepared to undertake the work, and, second, appropriations have been hard to get.

It is now twenty years since the organization of experiment stations, and a new era of progress and possibility is upon us and we should dismantle ourselves of the old robes of skepticism in regard to agricultural sciences. Some of the stations have always had high ideals, many of them have been bordering the scientific phase of agriculture for a good many years, but others have always held and still hold to the idea that they must busy themselves trying to satisfy the immediate demands of an uneasy public. Stations that do not busy themselves with the fundamental laws of agricultural science may always expect to have this kind of work to do; for the farmer finds out what is wrong before such stations are able to give out something more promising. In that case the farmer is the leader instead of the stations.

This condition was seen and fully contemplated by Mr. Adams, when he introduced a bill to increase the annual appropriations for the national and state experiment stations, else the special clause providing for a specific phase of station work would never have been incorporated in the bill. If all stations had conformed to the high ideal that some of them have always maintained, it would never have occurred to him that the funds must be set

aside for research work. He knew as we all know that the practical side of station work is indispensable, not only to the good of the farmers of the states, but to the theoretical work as well, and feeling, as I have intimated before, that many of them were depending altogether on this phase of the work, he set about to raise the standard by specifying that the new funds must be used to prosecute original research work, and to make his purpose carry he had the funds put into the hands of the Secretary of Agriculture, whose duty it is to see that the said funds shall not be misspent.

By virtue of these limitations, it becomes the duty of those who enter into the work to confine themselves strictly to the scientific phase of agricultural work. If they carry out the original purpose of the funds, they must in the course of their work hit upon the basic or fundamental principles that in the end determine real progress. The day of experimentation must yield to the inevitable day of investigation, and the investigator must not undertake a diversity of projects, but work along narrow lines that he may be fully able to concentrate his mind on the purely technically scientific phase of his work. In fact, there is little room to doubt that a project is admitted under the provision of the funds, only as the investigator interprets it from the standpoint of science. It may have practical application, but must be scientific. It may be work on old themes, but it must be a new phase of them.

In view of the considerable confusion brought about by the use of the Adams Fund at the stations, I wish to emphasize that no greater mistake can be made than to preach immediate application of results from those who are working under it. This was not contemplated by Mr. Adams. Farmers have to be educated gradually to an acceptance of any valuable scientific truth in agriculture, and to persuade them that they should keep abreast with men of science is to demoralize them in the extreme, and fill their minds with skepticism. When larger truths have become feasible, the farmers will be the ones to reap the benefit, and until they have become feasible,



let them be confined to the scientific workers. The man or institution that has not already begun to lay broad foundations may well be considered among the condemned. Only those who have the true spirit of investigation will win out under the Adams Fund. Instead of winning out by popularity, they will win out in spite of popularity, if they must work for popularity. Being able to reduce science to the popular is no indication of success, whether it be astronomy, meteorology, physiology, pathology, botany, bacteriology, medicine, or what-not. The fact that any truth becomes popular in any degree should be because of its broad application, and should, and generally does, bespeak years of sacrifice on the part of some investigator. Whatever is worthy to be called truth is worthy the best there is in us, and especially should this be so in agricultural science, where results will benefit almost the whole of the human race.

R. J. H. DeLoach,  
*Botanist*

GEORGIA EXPERIMENT STATION,  
EXPERIMENT, GEORGIA

LIKELY PLACES FOR EVIDENCE AS TO THE HISTORY  
OF THE EVOLUTION OF THE ANTHROPOID  
APES AND PRIMITIVE MAN

THE recent discovery of the chimpanzee in a part of Africa where it had not been previously known to exist enables us now to define a few regions in which the gorilla, the chimpanzee and the pygmies are found in conditions suggestive of the possibility of the discovery of fossils of their ancestry in a good state of preservation.

Until these new loci could be determined, the geological character of other regions where one of the three occurred was not such as to encourage hopes of the kind.

The writer is engaged upon the determination of these likely places, and wishes now to call attention to the matter, so that in the exploration going on in Africa the scientific importance of the matter may receive due attention. The pygmies are now known to have existed practically *in situ* for three thousand years, and there is abundant antecedent probability that the two great anthropoids

there now have been there for as great or greater a length of time.

Indeed, the writer believes that it will soon be possible to indicate localities, of less than a few hundred square miles in area, in which the likelihood of discovering these fossils is very great. His own explorations have partly been responsible for this conclusion, and an increasing knowledge of the geology and petrology of the great African crest has helped to augment the surmise. Correspondence on this subject is invited.

S. P. VERNER  
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SPECIAL ARTICLES

A SIMPLE REFLECTION GONIOMETER

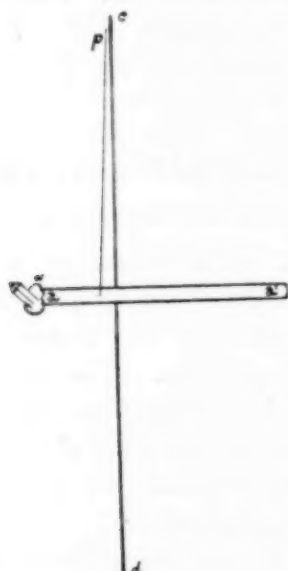
THE lack of a reflection goniometer has probably prevented many persons from measuring crystals and has consequently limited the study of crystals. The use of the contact goniometer is confined to fair-sized crystals with faces of appreciable size. Minute faces even on large crystals can not be measured by the contact goniometer.

In order to encourage the study of crystals the writer desires to describe a simple and convenient reflection goniometer which can be made of materials costing but fifty cents. It is simply Penfield's cardboard contact goniometer, model B,<sup>1</sup> fitted with an axis. The axis, upon one end of which the crystal is mounted, is provided with a pointer by which the interfacial angles may be read off.

The accompanying figure is a diagrammatic cross-section of the apparatus. *cd* is the cardboard protractor, consisting of a semi-circle of seven cm. diameter. *aa'* is the axis which is a cylindrical piece of wood four mm. in diameter and about five cm. in length. This axis must fit snugly into the eyelet of the protractor so as not to wobble when it is revolved. On one end of the axis is a piece of wax, *w*, upon which the crystal is mounted. *p* is a fine piece of wire attached to the axis, by means of which interfacial angles are read off on the protractor.

<sup>1</sup> Sold by E. L. Washburn & Co., New Haven, Conn. (price, 50 cents). It is better to cut off the celluloid arm of the protractor.

The crystal is mounted so that the intersection edges of the faces to be measured are parallel to and almost in line with the axis. The goniometer is held so that the crystal is close up to the eye, that is, with the protractor part extending perpendicularly in front of and away from one. The crystal is rotated by means of the axis until the reflected image of a window bar, electric light or similar object for a particular face coincides with



some line of reference such as a chalk mark on the floor, a ruler or the edge of a table. The reading is taken for this face, then the crystal is rotated until a similar image is obtained for an adjacent face. The difference between the two readings is the desired interfacial angle (supplement angle). And so on for other faces in the zone. As the protractor is a semi-circle, only  $180^\circ$  of a zone may be measured at one time and the crystal must be remounted for the rest of the zone. A face must always be connected up with its image.

The sources of error are: first, the edge can not be made to coincide exactly with the axis, and second, the angles can not be read much closer than quarter degrees. Yet the goniometer furnishes a simple method of measuring small crystals with bright faces even when the faces are minute, and of testing whether a given face lies in a given zone.

Some measurements obtained on pyrite crystals will show the accuracy of the instrument. The calculated angles are indicated

in parentheses alongside the measured angles.  $210 \wedge 311 = 25^\circ (25^\circ 14')$ ;  $311 \wedge 211 = 10^\circ (10^\circ 2')$ ;  $211 \wedge 111 = 20^\circ (19^\circ 28')$ ;  $210 \wedge 100 = 27^\circ (26^\circ 34')$ ;  $210 \wedge 111 = 38^\circ (39^\circ 14')$ . These faces were all bright and gave good images, but some of them were less than one half mm. in width.

AUSTIN F. ROGERS

STANFORD UNIVERSITY, CAL.

#### THE EXISTENCE OF *RÆSTELIA* *PENICILLATA* AND ITS TELIAL PHASE IN NORTH AMERICA

In taking up the study of the flora or fauna of a new region systematists attempt to make use of established names. In doing so they sometimes apply them to forms afterwards found to be wholly unlike those for which the name was originally intended. The name then occurs in the literature and the matter of determining what the species listed under it really are may require much subsequent study. Such is the case, in the mycological literature of North America, with *Ræstelia penicillata*,<sup>1</sup> a very old European name dating back to the time of the earliest mycological workers. It was chiefly applied by the first American authors attempting systematic work in this field to the form *Ræstelia pyrata*, now known to be distinctly American, but some other entirely distinct forms such as *Ræstelia globosa* and *Ræstelia lacerata* were often referred to it, so that it is not possible to determine in every instance just what species some earlier American writers had in mind when they used the name *R. penicillata*. It was frequently used in local catalogues and was much overworked, until somewhat later it was authentically shown by an American investigator<sup>2</sup> that the genuine *R. penicillata* of Europe was a very characteristic form differing materially from anything then known in this country. At that time, however, exploration had not extended beyond the eastern and central states, and that there should occur in the western mountains strange and different forms is not a matter of surprise, but that

<sup>1</sup> *Ræstelia penicillata* (Pers.) Fries, Sum. Veg. Scand., 2: 510. 1849. (*Æcidium penicillatum* Pers.; Gmel. Syst. Nat., 2: 1472. 1791.)

<sup>2</sup> Thaxter, *Proc. Am. Acad.*, 22: 265. 1886.



*R. penicillata* should exist there is an item of peculiar interest. The fact that the first specimens of it collected in that region were described as a new species, *R. fimbriata*,<sup>3</sup> serves as a natural continuation of the confusion regarding the species in America, and it may be properly remarked here that there has also been some confusion in Europe regarding its identity. To reiterate, then, the name *R. penicillata* was introduced into American literature and first made to apply to forms afterwards found to be distinctly American, it was next decided that it belonged exclusively to a European species not occurring in North America, and that view is probably the prevailing one at present.<sup>4</sup> Now, when we make out that we have the species to which the name in its proper usage belongs, we find that it has already been described under an independent name.

Discovery that this peculiar *ræstelia* form existed in this country immediately raised the question as to why the telial phase should also not occur. Turning to the work of European investigators<sup>5</sup> who had conducted culture experiments, it was soon made out that the *Gymnosporangium* stage was also very characteristic and unlike any of our well-known American species. An examination of several large herbaria had not revealed any such specimens, and since it was known to have such a peculiar form it seemed evident that it had never been collected in this country. The fact, however, that the *ræstelia* form existed here seemed convincing evidence that the telia should also occur. Several collectors in the proper regions were then interested in the

matter, the form was described to them and they were asked to be on the lookout for it in the field. The results were most gratifying, for two collections were made during the season of 1907, one in Colorado and another in Alberta, Canada.<sup>6</sup> These specimens agree well with the foreign ones in general appearance as well as in size and shape of the spores and other microscopic details. Their host is the dwarf juniper, *Juniperus siberica*.

Having concluded that *Ræstelia penicillata* existed in this country and with it, a *Gymnosporangium* identical with the form culturally connected with it in Europe, it becomes a point of interest to inquire the name of the *Gymnosporangium*. European writers usually refer to it as *Gymnosporangium tremelloides* of R. Hartig. Hartig established his name in 1882 after he had made cultures. *Ræstelia penicillata* has been known since 1791 and many authors have referred to it, therefore it did not seem probable that its telial phase, conspicuous as it is, should have remained uncollected until 1882. A study was then begun which ended in the decision that the original *Tremella juniperina* of Linnaeus's "Species Plantarum" was none other than the telial phase of *Ræstelia penicillata*. The specific name *juniperina* becomes, therefore, the name of the species, and if we refer it to *Gymnosporangium* the combination is *Gymnosporangium juniperinum* (L.) Mart., Fl. Crypt. Erlang. 333. 1817.

FRANK D. KERN

PURDUE UNIVERSITY,  
LAFAYETTE, INDIANA

#### RESEARCH DEFENSE SOCIETY<sup>1</sup>

A SOCIETY has been formed, with the name of the Research Defense Society, to make

<sup>2</sup>The Colorado specimen was collected at Laveta, June 20, 1907, by Miss Allen, of Professor F. E. Clement's party of summer students, and communicated by Professor E. Bethel, of the East Side High School, Denver, Colo. The Alberta collection was made at Laggan, July 20, 1907, by Professor E. W. D. Holway.

<sup>3</sup>Lord Cromer has accepted the presidency of the Research Defense Society, to the organization of which we recently called attention, and has addressed this letter to the editor of the London Times.

<sup>3</sup> Arthur, "New Species of Uredineæ," I., *Bull. Torrey Bot. Club*, 28: 666. 1901.

<sup>4</sup>Farl. Bibl. Index, 1: 77. 1905. "Under *Æcidium piratum* are given the references to the *Æcidium* of *Gymnosporangium macropus*, but, as the names *Æcidium piratum* and *Æcidium penicillatum*, the latter being in fact the name of a European species not found in North America, have been confused by some American writers, some of the following references may belong to other species."

<sup>5</sup>R. Hartig, *Lehr. Baumkr.*, 1: 133. 1882; Ed. Fischer, *Hedw.*, 34: 1-6. 1895; Tubeuf & Smith, "Diseases of Plants," 389. 1897.

known the facts as to experiments on animals in this country; the immense importance to the welfare of mankind of such experiments; and the great saving of human life and health directly attributable to them.

The great advance that has been made during the last quarter of a century in our knowledge of the functions of the body, and of the causes of diseases, would have been impossible without a combination of experiment and observation.

The use of antiseptics, and the modern treatment of wounds, is the direct outcome of the experiments of Pasteur and Lister. Pasteur's discovery of the microbial cause of puerperal fever has in itself enormously reduced the deaths of women in child-birth.

The nature of tuberculosis is now known, and its incidence has materially diminished.

We owe the invention of diphtheria antitoxin entirely to experiments on animals.

The causes of plague, cholera, typhoid, Mediterranean fever and sleeping sickness have been discovered solely by the experimental method.

Not only have a large number of drugs been placed at our disposal, but accurate knowledge has replaced the empirical use of many of those previously known.

The evidence before the Royal Commission has shown that these experiments are conducted with proper care; the small amount of pain or discomfort inflicted is insignificant compared with the great gain to knowledge and the direct advantage to humanity.

While acknowledging in general the utility of the experimental method, efforts have been made by a section of the public to throw discredit on all experiments involving the use of animals. The Research Defense Society will therefore endeavor to make it clear that medical and other scientific men who employ these methods are not less humane than the rest of their countrymen, who daily, though perhaps unconsciously, profit by them.

The society proposes to give information to all inquiries, to publish *précis*, articles and leaflets, to make arrangements for lectures, to send speakers, if required, to debates, and to

assist all who desire to examine the arguments on behalf of experiments on animals. It hopes to establish branches in our chief cities, and thus to be in touch with all parts of the kingdom; and to be at the service of municipal bodies, hospitals and other public institutions.

The society was formed on January 27 of the present year, and already numbers more than 800 members. It is not an association of men of science or of medical men alone; its membership has been drawn from all departments of public life, and includes representatives of every class of educated Englishmen and Englishwomen, including many who have taken an active part in the prevention of cruelty to animals. This fact is in itself a remarkable protest against the attacks which have been made on the researches that the society has been formed to defend.

The annual subscription is 5s. to cover working expenses, but larger subscriptions or donations will be gladly received. The acting hon. treasurer, *pro tem.*, is Mr. J. Luard Pattisson, C.B. (of the Lister Institute); and an account in the society's name has been opened with Messrs. Coutts and Co., 440 Strand. The hon. secretary is Mr. Stephen Paget, 70 Harley Street, W., to whom all communications should be addressed.

#### THE ADMINISTRATION OF SYRACUSE UNIVERSITY<sup>1</sup>

SYRACUSE UNIVERSITY,  
June 3d, 1908.

TO THE BOARD OF TRUSTEES OF SYRACUSE UNIVERSITY.

*Gentlemen:* I hereby decline to tender you my resignation as Dean and Professor of Mechanical Engineering in the L. C. Smith College of Applied Science, and ask you to

<sup>1</sup> This letter from Dean Kent to the board of trustees of Syracuse University is printed for the information of scientific men. It need scarcely be said that *SCIENCE* is ready to print a statement in justification of the administration of Syracuse University from the chancellor or from any responsible source.—Ed.



vote upon the question of my dismissal, which has been recommended by the Executive Committee. I thus give you the opportunity to vote against a faithful servant of the University in order to please the Chancellor.

I believe the trustees are satisfied that the vague, indefinite and unsupported charges made against me by the Chancellor have no foundation in fact but are based on his unreasoning imagination, and that if it were possible to give me a fair trial before a jury of expert engineering educators, I would not only be acquitted of all charges, but would be commended for my five years of faithful and efficient labors. I believe, moreover, that the majority of the trustees would gladly vote to retain me in my position but for the fact, as I stated in a letter to the trustees dated May 29th, that "they are afraid that if they voted against the Chancellor he would resign, and as the University needs money, which they think he alone can raise, he must be retained for his money-getting ability, no matter how objectionable he may be in other respects."

I think the trustees are mistaken in their idea that the Chancellor is the only one who can raise money for the University, for other colleges and universities all over the land are getting large sums of money without his aid. Even if it were true that he is needed as a money-raiser, I venture to suggest to the trustees that the two capacities in which the Chancellor is preeminent, viz., oratorical power and power of getting money, do not necessarily qualify him for the exercise of autocratic power over all the interests of a great university. They do not qualify him as a judicious spender of money, as an educator, as a judge of men, as a ruler of deans and faculties, as a disciplinarian, as a landscape artist, as an architect, or as a harmonizer of conflicting interests or ideas. The autocratic system of government of a university is a bad system.

A writer in the *Independent* of December, 28th, 1905, thus described the situation in a university under autocratic control:

When the wisdom of letting a man lord it over an aggregate of employees instead of conferring

with a company of scholars is questioned, the answer is the efficiency with which the autocrat can get things done. The president gets money and students and builds marble palaces. . . . The president may draw students from one institution to another; he does not create them. The marble palaces may be mausoleums for the preservation of the corpses of dead ideas and monuments erected to the decay of learning.

I suggest that if it is necessary to have an orator and a money getter for the chancellor of a university, there is no reason why his activity should not be confined to those things in which he is an expert. There is no reason why he should be given autocratic power in things in which he is not expert. The administration of these things had better be left to the separate colleges, to the University Senate, to committees of trustees, or to minor officials, as may be most suitable for the different objects to be accomplished.

In closing I wish to comment on a rumor which I am informed is being industriously circulated. It is to the effect that I have entered upon a fight to do all the damage I can to Syracuse University. Nothing could be further from the truth. In fact, I have often said, and I say now, that the fight I have been making is the best thing that could happen to the University. I am giving it a house-cleaning which it very much needs; I am bringing to the light of day some things that should be exposed; I have revealed the existence of certain diseases, and have prescribed the remedies; that is all. Some day the University will have a higher ideal than that of mere bigness, a Chancellor who is an educator and who will not try to be an autocrat, a board of trustees that will be in touch with educational affairs, and deans and faculties who can keep their positions without sacrificing their self-respect. Then the humiliation through which the University is now passing will be forgotten and it will reach the dignity of being one of the great intellectual centers of the world.

Very respectfully,

WM. KENT

HANOVER MEETING OF THE AMERICAN  
ASSOCIATION FOR THE ADVANCEMENT  
OF SCIENCE

SINCE the preliminary announcement of the special summer meeting to be held at Hanover, New Hampshire, June 29 to July 3, was published and mailed with the number of SCIENCE for May 29, the permanent secretary has learned that Sections I and L will not hold the meetings announced. Section B (Physics), and Section E (Geology and Geography), will therefore be the only sections to hold stated meetings for the reading of papers at Hanover. These sections will meet in conjunction with the American Physical Society and the Geological Society of America.

This fact need not deter members who wish to visit Dartmouth College at this time and take the excursions announced. Hanover is a charming little town and has a delightful summer climate. It is in the center of a most interesting region and members are urged to attend the meeting.

This reduction in the number of sections which will hold sessions makes it all the more important that members of Sections B and E and others who attend should go on the Certificate Plan. Members living only a short distance from Hanover, paying railroad fares of even less than one dollar, should take out a certificate and secure the two thirds of one fare reduction of the original ticket, since, unless at least 100 certificates are visited at Hanover, the reduction in fare will not be operative. This will mean that, owing to the neglect of nearby members to take out certificates, members coming from a distance may possibly be deprived of the advantage of the reduction.

L. O. HOWARD,

*Permanent Secretary*

SMITHSONIAN INSTITUTION,  
WASHINGTON, D. C.

SCIENTIFIC NOTES AND NEWS

THE inaugural session of the Dublin meeting of the British Association will be held on Wednesday, September 2, at 8:30 P.M., when Mr. Francis Darwin assumes the presidency, in succession to Sir David Gill, and will de-

liver an address. On Friday, September 4, the first evening discourse will be delivered by Professor H. H. Turner, of Oxford University, on "Halley's Comet." On Monday, September 7, the second evening discourse will be delivered by Professor W. M. Davis, of Harvard University, on "The Lessons of the Colorado Cañon." The concluding meeting will be held on Wednesday, September 9, at 3 P.M.

THE following appointments have been made to the staff of the Rockefeller Institute for Medical Research: P. A. Lewis, assistant in pathology; A. I. Kendall, assistant in bacteriology; A. R. Dochez, fellow in pathology; A. O. Shaklee, fellow in physiology and pharmacology. The following promotions have been made: John Auer, associate in physiology and pharmacology; Don R. Joseph, assistant in physiology and pharmacology; Alexis Carrel, associate in surgery; J. W. Jobling, associate in pathology; Benjamin T. Terry, assistant in protozoology; Donald D. Van Slyke, assistant in biological chemistry; Walter A. Jacobs, assistant in biological chemistry; Bertha I. Barker, fellow in pathology; R. V. Lamar, fellow in pathology.

PROFESSOR F. SILVESTRI has come to New York for the purpose of studying the collections in The American Museum of Natural History, whose guest he will be during the summer months. Professor Silvestri holds the chair of entomology in the School of Agriculture, Portici, Italy.

THE towns of Breslau and Bremen have given £500 each; those of Halle and Königsberg, £150 each; those of Stettin, Duisburg and Altona, £50 each; and the German Medical Societies' Union, the German Public Health Association and the German Surgical Society, £25 each, towards the establishment of the Robert Koch Institute.

THE University of Pennsylvania has conferred its doctorate of science on Dr. Edwin G. Conklin, who leaves the university to accept the headship of the department of biology of Princeton University.

GEORGE WASHINGTON UNIVERSITY has conferred its doctorate of laws on Mr. F. J. V.



Skiff, director of the Field Museum of Natural History, Chicago.

SIR FRANK LASCELLES, the British ambassador in Berlin, attended on May 23 the celebration of the eightieth anniversary of the foundation of the Gesellschaft für Erdkunde zu Berlin and received, on behalf of Captain R. F. Scott, R.N., commander of the British National Antarctic Expedition, 1900-4, the gold medal which the society has conferred upon him.

DR. B. H. SCOTT, botanical secretary of the Linnean Society, has been elected president to succeed Professor W. A. Herdman. The gold medal of the society has been conferred on the Rev. T. R. R. Stebbing, F.R.S.

MR. ALFRED MARSHALL, who recently resigned the professorship of political economy at Cambridge, and with it his professorial fellowship at St. John's College, has been elected an honorary fellow at that college.

DR. HERMANN KOBOLD has become editor of the *Astronomische Nachrichten*.

PROFESSOR ROBERT DEC. WARD, of Harvard University, sails for Rio de Janeiro on June 20, as a member of the Shaler Memorial Expedition to South America. Professor Ward will spend about seven weeks in Brazil, where he intends to make certain climatological and geographical studies. He returns to the United States at the end of September.

DR. EDMUND OTIS HOVEY of the American Museum of Natural History, who visited the West Indies immediately after the eruptions of Mt. Pelé and La Soufrière in 1902, is now making an extended tour of the islands with a view to supplementing his studies in vulcanology. It is expected that he will return to New York about July 23.

PROFESSOR COLLIER COBB, of the University of North Carolina, has joined Professor W. M. Davis for geographical work in Italy.

DR. JAMES H. WOODS, who occupies the position of assistant professor of philosophy at Harvard University, is at the present time continuing his studies of the several Hindu systems at Maha-Baleshwara, a hill-station in the Western Ghats, about one hundred miles southeast of Bombay.

At the first annual meeting of the Worcester Polytechnic Institute Chapter Sigma Xi, on June 8, Dr. Arthur Gordon Webster, professor of physics at Clark University, gave the address on "The Object of Scientific Investigation."

THE annual address before the Colorado Chapter of the Sigma Xi, at the University of Colorado, was delivered on May 30, by Dr. Florian Cajori, of Colorado College. Dr. Cajori took as his subject the history of the theory of the conservation of energy.

DR. C. P. STEINMETZ delivered a lecture in the Engineering Societies' Building, New York, on Sunday, May 17, before the students and friends of the New York Electrical Trade Schools, his subject being "The Future of Electricity."

THE address at the ninth annual commencement of the Clarkson Memorial School of Technology on June 12 will be given by Dr. Henry Taylor Bovey, dean of the Faculty of Applied Science of McGill University.

THE British Association of Technical Institutions has decided to make the following awards: Prize for the best essay on "The Bearing of Technical Education on Industrial Progress" to Dr. John Ryan, Grove-house, Milltown, county Dublin, £25; and for the best essay on "The Bearing of Technical Education on Agriculture and Industries of a Rural Character" to Mr. Edgar Chamberlain, Municipal Technical School, Monk's-road, Lincoln, £25.

At the annual meeting of the American Neurological Association, held recently in Philadelphia, the following officers were elected: *President*, Dr. S. Weir Mitchell, Philadelphia; *vice-presidents*, Drs. Pearce Bailey, New York, and Frank W. Langdon, Cincinnati; *secretary and treasurer*, Dr. Graeme M. Hammond, New York City, and *councilors*, Drs. Henry M. Thomas, Baltimore, and Charles W. Burr, Philadelphia.

At the annual meeting of the Department of Microscopy of the Brooklyn Institute of Arts and Sciences the following officers were elected for the ensuing year: *President*, John

J. Schoonhoven; *vice-president*, Thomas I. Miller; *secretary*, Agnes Vinton Luther, *curator*, James Walker. This is Mr. Schoonhoven's fourth year as president of this society.

#### UNIVERSITY AND EDUCATIONAL NEWS

THE Court of Appeals at Albany, N. Y., has handed down a decision in which the efforts of the next of kin of Josephine Louise Newcomb, widow of Warren Newcomb, who died in New York City in 1901, to set aside her will, executed in Louisiana, and to secure a portion of her estate, are nullified and her bequest of her entire estate of about \$2,000,000 to the H. Sophie Newcomb Memorial College of New Orleans, a department of Tulane University, is sustained.

At the commencement exercises of the Massachusetts College of Pharmacy it was announced that the college had acquired an endowment fund amounting to \$150,000 by the terms of the will of Warren D. Potter. Mr. Potter, who was a wholesale druggist, died a number of years ago, and by the provisions of his will a residue of his estate reverted to the college two years after the death of his wife.

GEORGE WASHINGTON UNIVERSITY has received a gift of \$5,000 from the alumni association of Colorado.

In the period from 1893 to 1899 the funds of Stanford University, including the estate of Mrs. Stanford herself, were completely tied up by litigation, leaving the university no income save the sum annually allowed by the Probate Court to Mrs. Stanford for the maintenance of her personal service. During this period Mrs. Stanford devoted all funds accessible to her to the maintenance of the institution. Among other things she possessed a very valuable collection of jewels, the gift of her husband, many of them being of historic interest. These were held by her in reserve for the use of the university, about half of them being sold in London by her at the time of the queen's jubilee, and the proceeds were made available to the university at a time when they were sorely needed. By the

terms of her will the rest of these jewels were to be sold and a "Jewel Fund" constituted, the proceeds of which were to be devoted in perpetuity to the purchase of books for the University Library. By the act of the trustees of the university this fund has now been segregated as a library endowment. The fund as at present constituted amounts to \$500,000, the interest annually being \$25,000.

THE report of the syndicate appointed to superintend the provision of buildings for the Department of Agriculture, at Cambridge, states that the university has provided a suitable site adjoining the Botany School, and that a sum of nearly £13,000 has been subscribed or promised by the Drapers' Company and by a number of prominent landowners towards the cost of the building. Plans have been prepared which meet with general approval, but the building can not be begun until a further sum of at least £2,000 has been subscribed.

DICKINSON COLLEGE, Carlisle, Pa., is this week celebrating the hundred and twenty-fifth anniversary of its foundation. Oberlin College celebrates its seventy-fifth anniversary.

DR. JOSEPH BARRELL has been promoted to a professorship of geology at Yale University.

DR. S. R. WILLIAMS, tutor in physics in Barnard College, Columbia University, has been appointed associate professor and head of the department of physics at Oberlin College.

At Harvard University Mrs. Wilfred MacDonald has been appointed instructor in mathematics, and Mr. D. C. Rogers, assistant in applied psychology at Harvard University.

WARNER BROWN, Ph.D. (Columbia), assistant in psychology in Columbia University, has been appointed instructor in psychology in the University of California.

At the Northwestern University Medical School, Dr. Prentiss, of Harvard University, has been appointed assistant professor of anatomy, and Dr. S. Walter Ransom, associate in anatomy.

DR. WOLFGANG OSTWALD has qualified as docent in physiology in the University of Leipzig.